VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF SAFETY ENGINEERING | DEPARTMENT OF OCCUPATIONAL AND PROCESS SAFETY

CESAR Centre of Excellence for Safety Research

HYSACO

High-pressure cylinder failure under fire scenario – investigation of the consequences

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loss prevention 2025

Introduction

Fire and Industrial Safety

Explosion Prevention and protection

Hydrogen safety research

REFRESH

HYSACO

CESAR Centre of Excellence for Safety Research

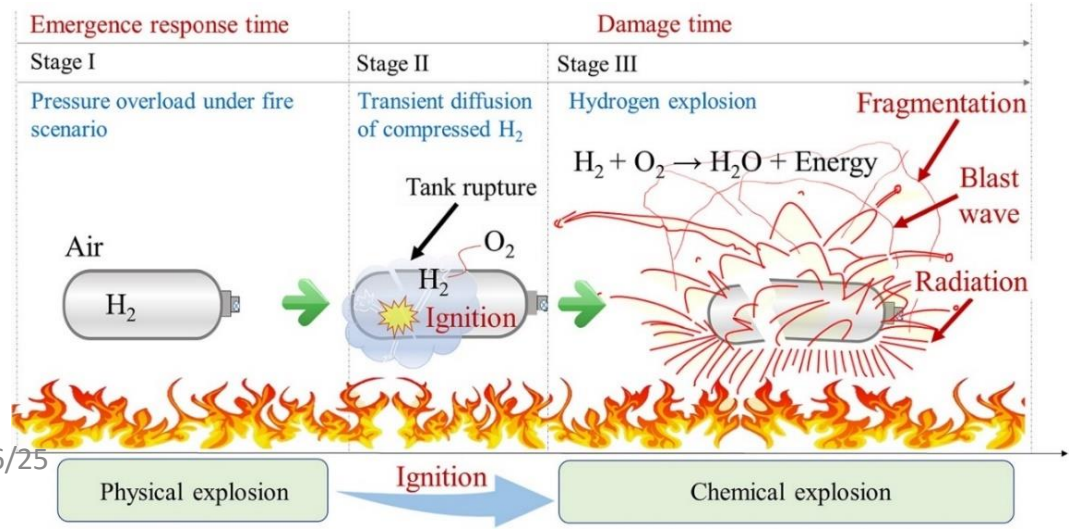
- Why?
- Experimental test
- Results
- Future overlook…
- Centre of Excellence for Safety Research
- Conclusion

Why is this important?

Sources: www.denik.cz / https://www.youtube.com/watch?v=nWxfJQfJo7s&ab_channel=motofoko / www.pozary.czh

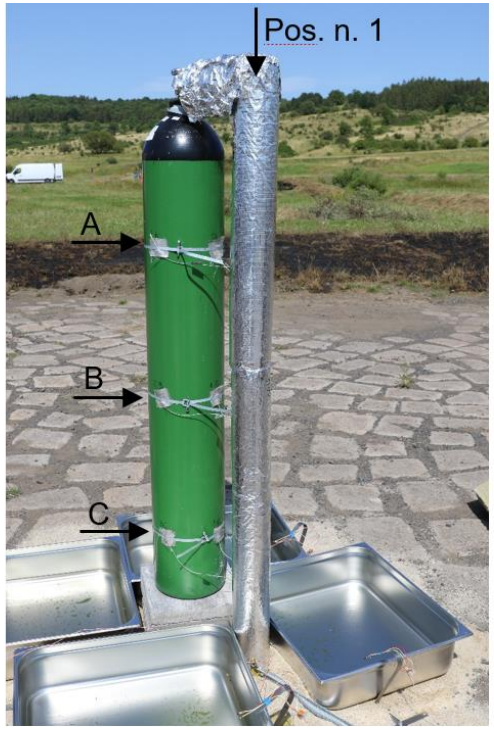
Why is this important?

- Still widely used in industry and households
- In the case of fire present severe risks, including catastrophic failure
- Hydrogen safety is increasingly crucial as adoption grows
- Understanding high-pressure cylinder behavior (Hydrogen & Nitrogen) under fire conditions.
- Assessing fragmentation and fireball formation.
- Previous incidents involving cylinder failures.
- Application in hydrogen-powered transportation and energy storage.

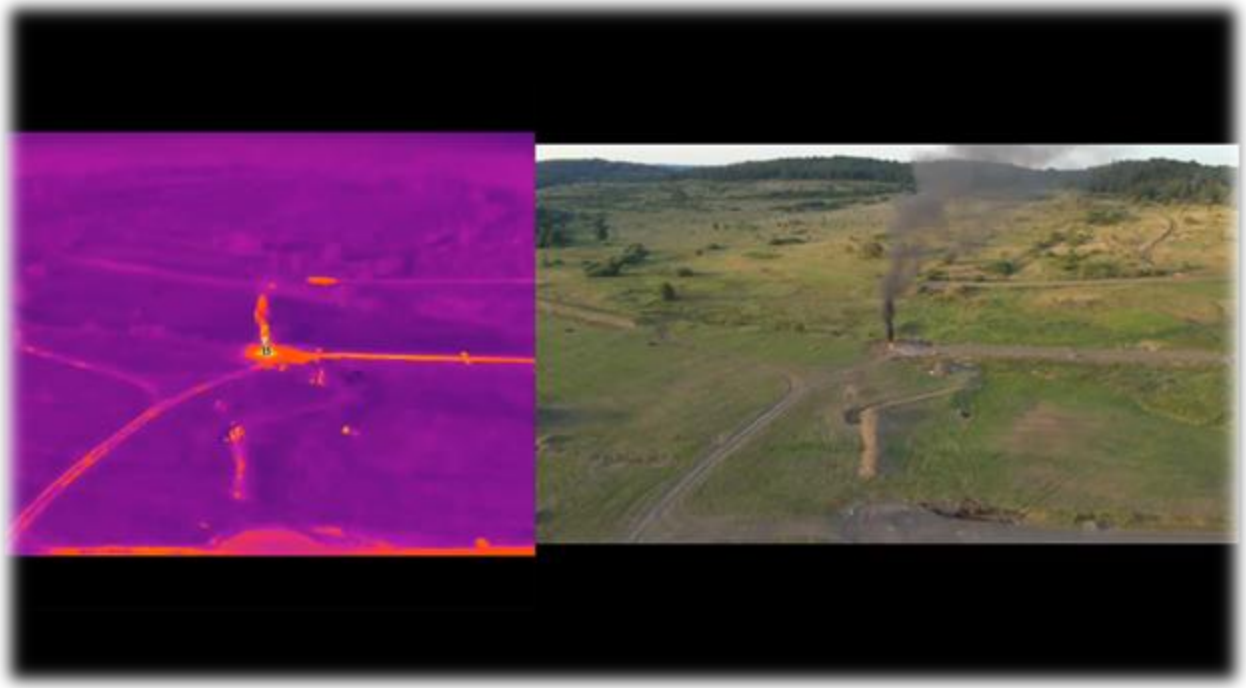


Experimental study

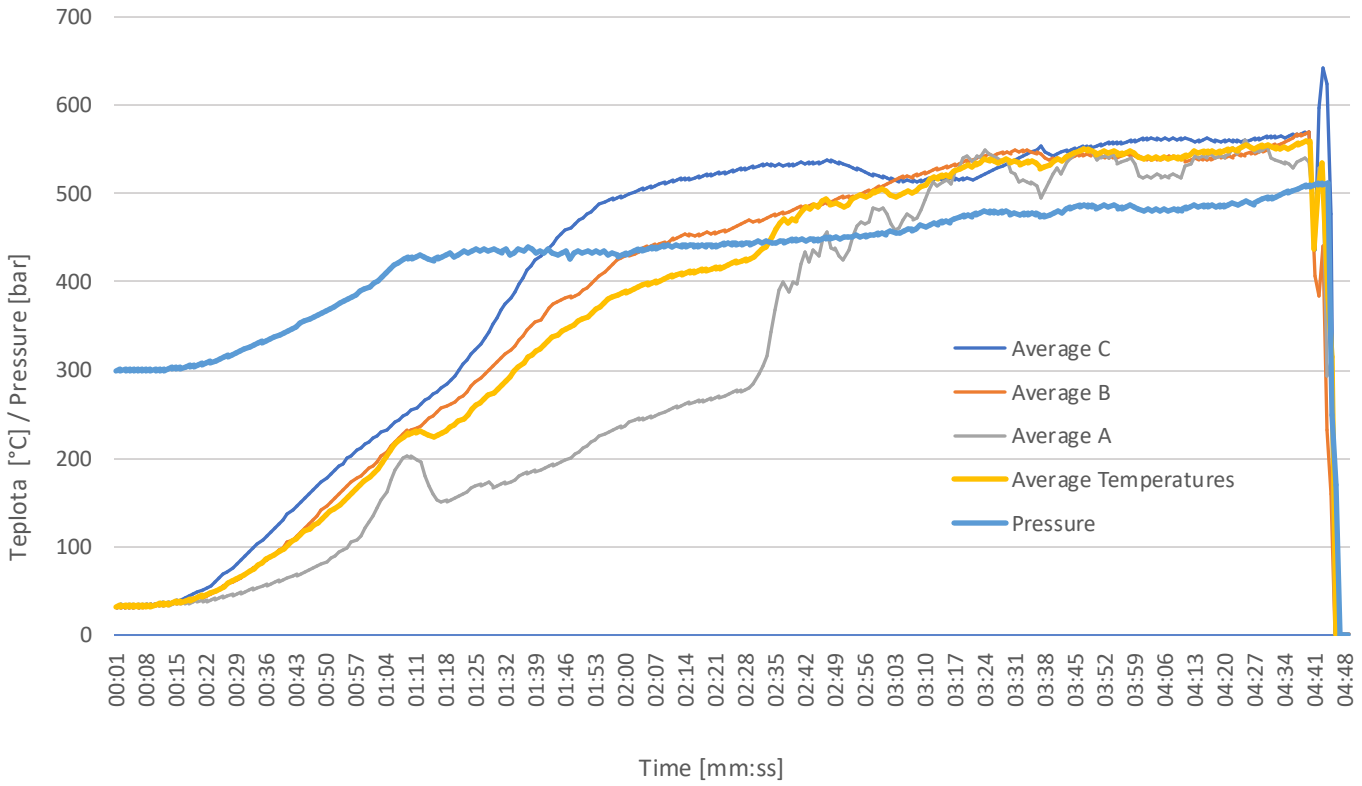
Hydrogen pressure cylinder	• 50 litres • 300 bar
Nitrogen pressure cylinder	• 50 litres • 300 bar
Fire	• 80 litre of diesel fuel • 4 tubes • Pyrotechnical ignition
Recording	• Shell's temperature • Internal pressure • Cameras, drones, thermovision …

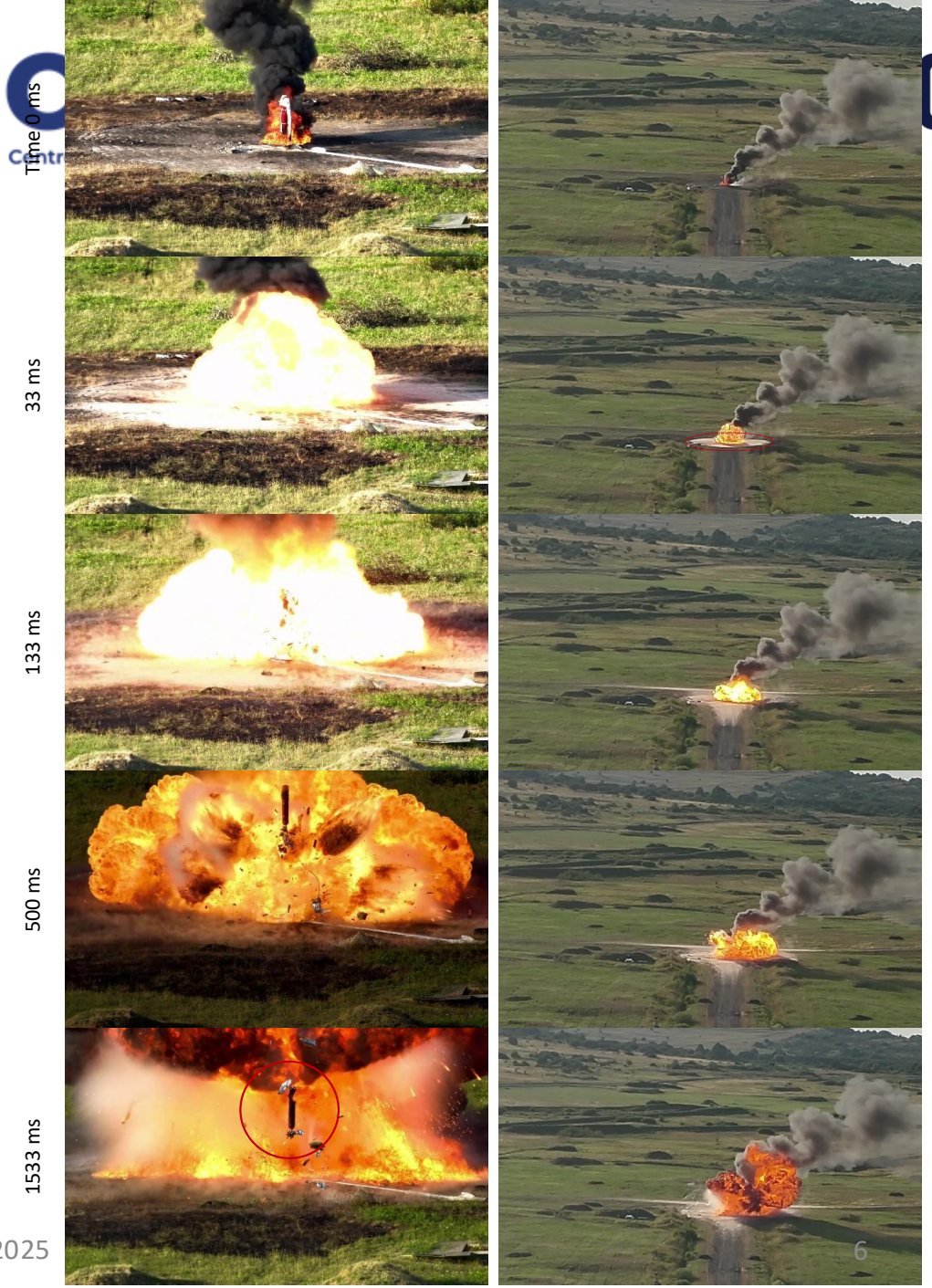


Results

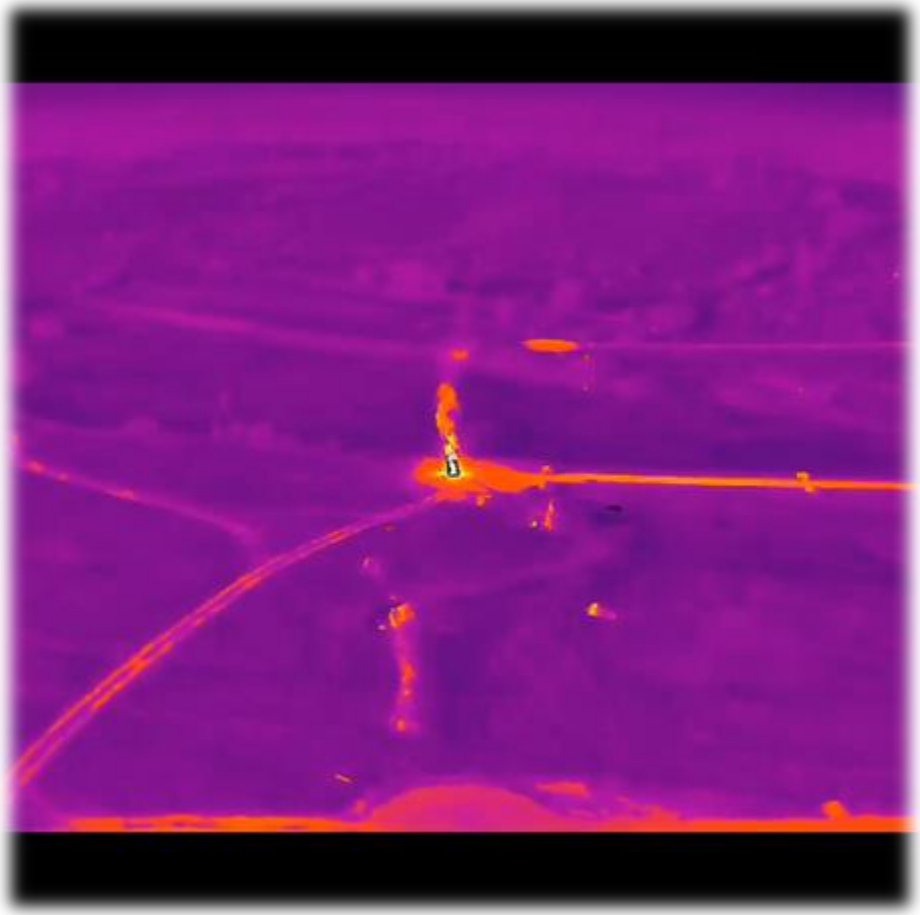


Hydrogen – temperatures and pressure



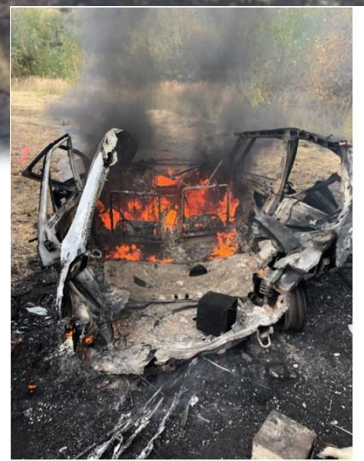


Pressure cylinder fragmentation



Safety and future

Safety and future



CENTRE OF EXCELLENCE FOR SAFETY RESEARCH

ERA Chair: Prof. Ernesto Salzano

Full Professor of Chemical Plant Design at the University of Bologna, Italy.
Director of Studies for Chemical and Process Engineering

Strengthening research capacity - increasing research excellence of FSE
Connecting with European research - participation in international networks, projects, and other initiatives

The multidisciplinary team will include international experts covering explosion protection, fire safety, risk analysis and crisis management and other expertises.

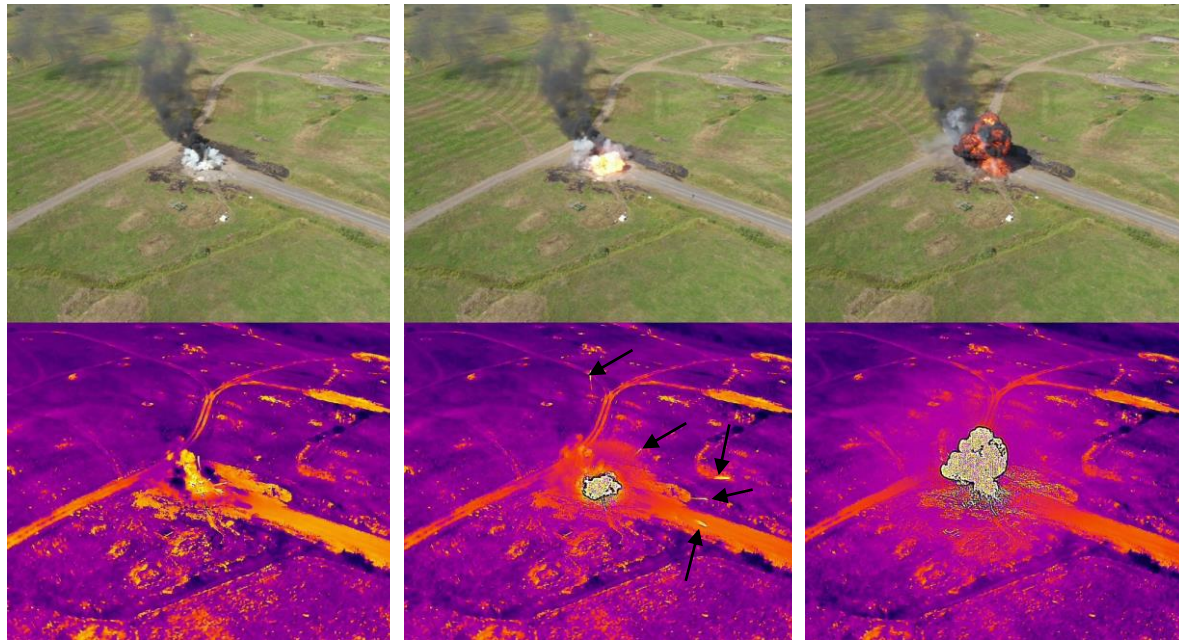
Prof. Valeria **Di Sarli** Dr. Rafal **Porowski** Dr. Sven **Eckart** Dr. Stefan **Spitzer** Dr. Enrico **Danzi**

Young Researchers - Postdocs and PhD students will play a key role, receiving mentorship and career development opportunities through the CESAR initiative

Cooperation with a strong network of partnerships within academia and industry worldwide.

Project coordinator and VSB group leader – Dr. Vojtěch Jankůj

Conclusion



- High-pressure cylinders pose a major explosion risk in fires.
- Hydrogen cylinders result in extensive fragmentation and large fireballs.
- Thermal imaging and high-speed cameras provide crucial insights.
- Safety recommendations for industry and emergency responders.

Thank you for your attention

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